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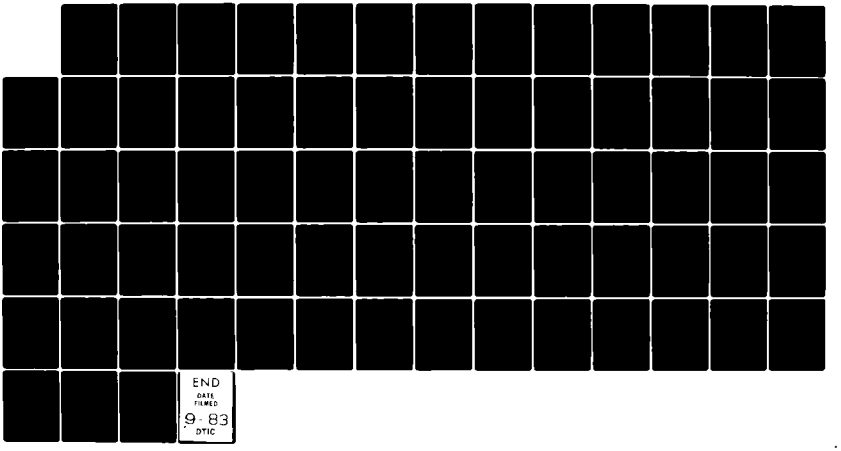

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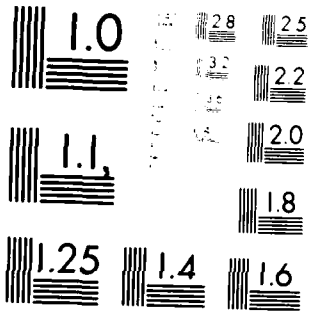

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AFGL-TR-83-0127

ENGINEERING SERVICES IN SUPPORT OF THE AFGL SOUNDING ROCKET PROGRAM

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Final Report
1 August 1980 - 25 March 1983

25 March 1983

Approved for public release; distribution unlimited

AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
HANSCOM AFB, MASSACHUSETTS 01731

This report has been reviewed by the ESD Public Affairs Office (PA) and is releasable to the National Technical Information Service (NTIS).

This technical report has been reviewed and is approved for publication.

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This report documents system engineering support provided to the Sounding Rocket Branch of AFGL under Contract number F 19628-80-C-0125. Specific tasking areas in this contract included the following:

- Engineering and Test Analysis
- Detailed Test Plans and Procedures
- Engineering Field Support
- Engineering Support for Design Reviews
- Equipment Fabrication
- Testing Fabricated Items

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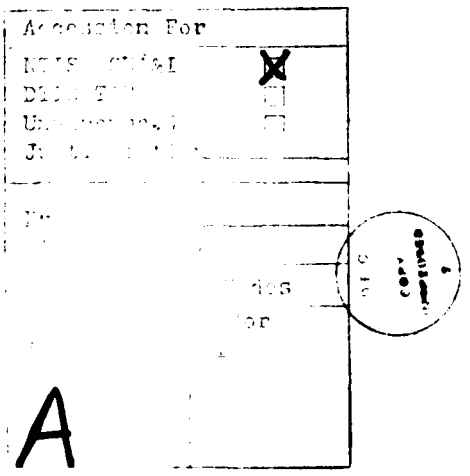
TABLE OF CONTENTS

		Page No.
1.	INTRODUCTION	1
2.	ENGINEERING AND TEST ANALYSIS	2
3.	DETAILED TEST PLANS AND PROCEDURES	5
4.	ENGINEERING FIELD SUPPORT	6
5.	ENGINEERING SUPPORT FOR DESIGN REVIEWS	7
6.	EQUIPMENT FABRICATION	9
7.	TESTING FABRICATED ITEMS	10
8.	SUMMARY	11
APPENDICES		12
APPENDIX A	Interim Technical Report, 1 August 1980 to 1 August 1981	A-1
APPENDIX B	*Interim Technical Report, 1 August 1981 to 31 July 1982*	B-1



1. INTRODUCTION

1.1 On 1 August 1980, the Analytical Systems Engineering Corporation (ASEC) was competitively awarded a contract to provide system engineering support to the Air Force Geophysics Laboratory (AFGL) to be managed by the Sounding Rocket Branch (AFGL/LCR). The three years basic contract period of performance was extended, on 5 May 1981, to 31 July 1984. During the contract, extraordinary levels of technical support in various skill mixes became necessary in order to support unexpected projects and high levels of effort. ASEC responded in every case resulting in consuming contractual labor resources allowable prior to expiration of the period of performance.

This is the Final Technical Report on ASEC's contract to provide system engineering support to the Air Force Geophysics Laboratory. It covers the period from 1 August 1980 to 25 March 1983. The overall activity has embraced work concerning payloads borne by rockets, balloons and the space shuttle.

1.2 ASEC has submitted two annual Interim Technical Reports and thirty one monthly Research and Development Status Reports. The two Interim Technical Reports are attached to this Final Technical Report, as Appendices A and B, covering the period of performance from 1 August 1980 to 31 July 1982. The main body of this report covers the period from 1 August 1982 to 25 March 1983. Collectively, the two Interim Technical Reports and this Final Technical Report cover the entire contractual period of work performance. Specific task areas are presented in the body of this report for the period between 1 August 1982 to 25 March 1983 in the following order:

- Engineering and Test Analysis
- Detailed Test Plans and Procedures
- Engineering Field Support
- Engineering Support for Design Reviews
- Equipment Fabrication
- Testing Fabricated Items
- Summary

2. ENGINEERING AND TEST ANALYSIS

2.1 LAIRTS. The work accomplished on the computer program to calculate thermodynamic properties of cryogenic helium for use in the LAIRTS dewar performance predictions were delivered to Mr. Roy Walters, AFGL/LCR.

2.2 SENSOR EJECTION SYSTEM (SES). Technical support provided for SES program engineering and test analyses included the following:

2.2.1 The SES Interface Control Document (ICD) was updated and delivered in preparation for establishment of a configuration design baseline at the Technical Design Review (TDR) conducted on 10 September 1982. The ICD was updated to reflect changes and actions resulting from the TDR and became a baseline document as of completion of the TDR. Subsequently, Revisions A and B were prepared and delivered. Revision B was distributed to participants at the Field Readiness Review, on 27 January 1983.

2.2.2 A schedule for integration of the payloads and vehicle and for pre-launch checkout and launch sequence activities was prepared and delivered.

2.2.3 Draft and final copies of the telemetry technical data packages were completed and delivered.

2.2.4 The SES R&D Management Report was prepared and distributed.

2.3 SPICE II. Radar Beacon malfunction data for the SPICE II flight in September was received and added to the ASEC maintained data depository for subsequent compilation with post-flight failure analysis reports.

2.4 SOUNDING ROCKET BRANCH OPERATION REQUIREMENTS HANDBOOK. An initial outline was prepared reflecting the inputs of key individuals in the Sounding Rocket Branch. The handbook outline was distributed for comment within AFGL. Further work ceased in November due to staff reductions and other priorities.

2.5 BALLOON ALTITUDE MOSAIC MEASUREMENTS (BAMM) PROGRAM. Technical support for the BAMM program included the following:

2.5.1 Graphic flight data in the form of video/sound recordings were edited and assembled to depict typical flight activity sequences. Dual video cassette recorders and editing controller were used to document launch operations. Six real-time recordings produced by the Dynalectron Corporation were edited into a video film which was used as introductory material for the NASA Program Manager of the Galileo Project.

2.5.2 Work was initiated on a plan for BAMM IIA milestone planning and tracking using CPM-PERT methods. This plan, intended for use on the mid-September 1983 launch on the Gulf of Mexico coast, was not completed.

2.5.3 The scheduling work also encompassed engineering launch and recovery using C-130 aircraft to recover the new two-segment, air separable platform being designed and built by the Physical Sciences Laboratory of the New Mexico State University for a January 1984 test launch. The schedule was completed and delivered in October 1982.

2.5.4 Galileo Program. Based on some data provided by the General Electric Corporation, a countdown sequence and an operations plan book were prepared for the planned July 1983 launch.

2.6 MULTISPECTRAL MEASUREMENTS PROGRAM (MSMP). The following technical support was provided for the MSMP.

2.6.1 The draft TEM-3 flight report was reviewed, edited and prepared for distribution with ASEC assistance.

2.6.2 Material for AFGL briefings and technical discussions were prepared for a TEM-3 workshop held at the Space Division in December 1982.

2.7 EARTH LIMB CLUTTER (ELC) PROGRAM. General support for the ELC-1 project was provided as part of the overall engineering and test analyses tasks for the Background Measurements Program (BMP). These support tasks included support for the weekly BMP status meetings and action items documentation and tracking.

2.8 OTHER. Considerable technical analyses and documentary assistance of a programmatic nature were provided to AFGL Program Managers and System Managers. The numerous briefings, descriptive papers, video cassettes and 16mm films, multi-color illustrations, and equipment purchases are detailed in the monthly Research and Development Status Reports. These are not listed herein since these documents are results of the work otherwise described in this report.

3. DETAILED TEST PLANS AND PROCEDURES.

3.1 ELC-1. The following test plans were revised and updated to meet requirements of this project:

600-3	Structure Bend Tests
600-4	System Test (cold Sensor)
600-5	Payload Functional Test (Warm Sensor)
600-6	Payload Shock and Vibration
600-8	Cover Open Test
600-9	Payload Spin Balance
600-10	Pad Interface Test
650-3	TM Batteries (3.6ah), Shock and Vibration Qualification Testing
-	IR Sensor Electronics, Thermal
650-8.1	Link I&II PCM Encoders, Thermal Cycling
650-9	PCM Encoders, Shock and Vibration
650-10	Digital Timers, Thermal
650-11	Digital Timers, Shock and Vibration
650-27	C-Band Beacons, Seal Test
650-28	C-Band Beacons, Thermal
650-29	C-Band Beacons, Shock and Vibration

3.2 TEST PLANS AND REPORTS. A draft of a Test Program Plan and a series of General Test Plans for development, qualification and flight acceptance testing were written and delivered. The objective of this is to provide a cohesive overall program plan and a selective set of test plans for each sounding rocket project tailored to project requirements. The benefits of this approach include a distinct traceability of flight requirements to tests conducted, format standardization, elimination of redundancies, and reduction of documentation volume.

4. ENGINEERING FIELD SUPPORT

4.1 SPICE-2. A complete set of malfunction reports and test reports were retrieved from the data depository for AFGL review in support of the Flight Readiness Review prior to the scheduled 14 September 1982 launch

4.2 BAMM. Technical support for a series of planning, coordination and progress review meetings were provided at various facilities. These included the following:

4.2.1 A balloon planning conference at the Physical Sciences Laboratory (PSL), Las Cruces, NM in August.

4.2.2 A technical review meeting at Visidyne in support of OP and LCA personnel at a payload briefing in November.

4.2.3 A BAMM IIA progress meeting at the Aerospace Corporation to define C-130 aircraft air snatch recovery program details. A Program Status Review on the same trip to review progress on the Grumman Aerospace Corporation payload at Irvine, CA. A third visit on this trip was for monitoring packing of Mark 8A parachutes at Paradynamics in South El Monte, CA. The two Mark 8A and a stabilization parachute obtained by AFGL through ASEC were packed for flight at this time. These were then sent to PSL.

5. ENGINEEERING SUPPORT FOR DESIGN REVIEWS

5.1 SES. Technical support was provided to prepare AFGL presentations for the Technical Design Review (TDR) conducted on 10 September 1982. Documentary support provided included agendas, minutes, action items and physical arrangements. Subsequent support continued to prepare for the Field Readiness Review conducted at AFGL on 27 January 1983, and the Flight Readiness Review conducted at WSMR on 19 February 1983.

5.2 BAMM. AFGL/LCA presentations were prepared and delivered in support of the BAMM IIA Critical Design Review (CDR) held at PSL on 15-17 December 1982. ASEC personnel participated in the CDR and provided engineering design analysis and consultive support for platform stabilization and navigation subsystems prior to the CDR. Some novel techniques are to be employed in stabilization of the platform and in position correlation with navigation subsystems. Equations were reviewed and positively confirmed with PSL personnel, thereby providing a reasonable confidence of success to AFGL personnel.

5.3 MSMP. Technical and programmatic support were provided to various reviews of the MSMP.

5.3.1 In September, tasking and work unit files were updated in preparation for the AFGL in-house, semi-annual Technical Management Review. System status meetings were attended and assistance was provided to formulate proposed courses of actions for HPTEM-1 and -2 for presentation by AFGL to the Space Division in October.

5.3.2 Assistance was provided to the MSMP Program Manager to prepare an agenda and a presentation for the TDR conducted in December aiming towards an April 1984 launch of HPTEM-1. Documentary support to generate minutes and action items was provided at the TDR.

5.3.3 Assistance was provided to refine a Mission Readiness Review (MRR) checklist and to distribute the checklist within the Optical Physics Division in preparation for subsequent program reviews.

5.4 ELC-1. Technical support was provided to prepare various documents for use at the CDR conducted in December at AFGL. A Design Review Handbook was prepared, published and distributed at the CDR. Presentations by the AFGL System Manager were prepared. The data gathered and prepared included: payload description; experiment timeline; test plans, reports and status of component testing; an integrated project schedule; and the technical data for mission telemetry.

6. EQUIPMENT FABRICATION

The third and final PCM telemetry assembly was completed and delivered to AFGL/LCA for the BAMM IIA program in October.

7. TESTING FABRICATED ITEMS

7.1 SPICE-2. A prelaunch validation test report was completed in August, TR 500-4.3, System Test (Cold Sensor). This test report documented tests conducted at WSMR. A summary report was prepared and delivered on the Space Vector Corporation (SVC) response to Action Item 11-82. This report summarized the ten SVC malfunction reports and corrective actions taken to document the resolution of Attitude Control System problems encountered during pre-launch testing at WSMR.

7.2 ELC-1. Assistance was provided in support of component testing and preparation of test reports. These included processing and recording malfunction reports, tracking of corrective actions and preparation and distribution of test reports.

Malfunction Reports:

MR-FB21-68	Link 2 Encoder

Test Reports:

TR 650-2	TM Batteries, Temperature
TR 650-3	TM Batteries, Shock and Vibration
TR 650-8.1	PCM Encoders Link 3, Thermal Cycling
TR 650-9.1	PCM Encoders Link 3, Shock and Vibration
TR 650-9.2	PCM Encoders, Shock and Vibration
TR 650-10	Digital Timers, Thermal Cycling
TR 650-11	Digital Timers, Shock and Vibration
TR 650-15/17	Logic and Auxiliary Electronic Boxes, Thermal Cycling
TR 650-27	C-Band Beacons, Seal Test
TR 650-28	C-Band Beacons, Thermal Cycling
TR 650-29	C-Band Beacons, Shock and Vibration

8. SUMMARY

During the 32 months' period of performance on this contract, ASEC has actively participated in numerous sounding rocket projects, balloon projects and a space shuttle project. The system engineering support rendered to various AFGL science and engineering branches included engineering design, design analysis, test planning and test management and reporting, field engineering, equipment fabrication and installation, and development and production of program documentation. A central data depository was maintained to record the technical activities in each project.

Through co-location of the majority of the ASEC support team within AFGL facilities, daily communication was efficiently and quickly executed. The minimization of distribution time for multiple iteration of various documentation maximized productivity for both AFGL and ASEC personnel.

APPENDIX A

ENGINEERING SERVICES IN SUPPORT OF THE AFGL SOUNDING ROCKET PROGRAMS

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20 February 1982
Interim Report for Period 1 August 1980 - 1 August 1981

Air Force Geophysics Laboratory
Air Force Systems Command
United States Air Force
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TABLE OF CONTENTS

		Page No.
1.0	INTRODUCTION	A-3
2.0	ENGINEERING AND TEST ANALYSIS	A-4
3.0	DETAILED TEST PLANS AND PROCEDURES	A-4
	3.1 TEST SUPPORT DOCUMENTATION	A-5
4.0	ENGINEERING FIELD SUPPORT	A-5
5.0	ENGINEERING SUPPORT FOR DESIGN REVIEWS	A-6
6.0	EQUIPMENT FABRICATION	A-6
7.0	SUBJECT FABRICATED ITEMS TO TESTING	A-6
8.0	SUMMARY	A-7

LIST OF TABLES

1.	ASEC ENGINEERING AND TEST ANALYSIS	A-8
2.	DETAILED TEST PLANS AND PROCEDURES	A-9
3.	TEST SUPPORT DOCUMENTATION	A-15
4.	ENGINEERING FIELD SUPPORT	A-16
5.	ENGINEERING SUPPORT FOR DESIGN REVIEWS	A-17
6.	EQUIPMENT FABRICATION	A-18
7.	TESTING FABRICATED ITEMS	A-19

1.0 INTRODUCTION

On 1 August 1980, Analytical Systems Engineering Corporation (ASEC) was awarded a contract to provide system engineering support to the Air Force Geophysics Laboratory (AFGL) Sounding Rocket Branch (LCR). Contracting officer for this effort is Mr. R. Von Duey and the Laboratory Contract Manager is Mr. Charles D. Howard. The contract was a competitive award for a period of three years. On 5 May 1981, the contract was modified pursuant to the "changes" clause to extend the period of performance to 31 July 1984.

Specific tasks in the system engineering contract include the following:

- Engineering and Test Analysis
- Detailed Test Plans and Procedures
- Engineering Field Support
- Engineering Support for Design Reviews
- Equipment Fabrication
- Testing Fabricated Items

ASEC has submitted monthly Research and Development Status Reports which outline progress in each of the specified task areas. Work has been performed on two independent sounding rocket programs (Background Measurements Program and Multispectral Measurements Program), high altitude balloon programs and several space shuttle experiments.

The purpose of this Interim Technical Report is to collect all progress in the above task areas during the first twelve months of the contract and present it in a single document.

To accomplish this purpose the remainder of this report is organized into the six task areas listed above.

2.0 Engineering and Test Analysis

Table 1 describes the major engineering anaylses conducted by ASEC during the reporting period. ASEC's approach to analysis is also suggested by the outline of Table 1. The first step in attacking any problem is to clearly define the specific problem you wish to solve. Once the problem is defined, engineering and mathematical tools are employed to model a solution. Some initial testing is often necessary to determine coefficients or properties of materials which relate to the problem. When a mathematical model is developed the solution for a specitic problem is immediately available. To make a more general solution and to avoid repeating this work for similar problems in the future, the mathematical solution is programmed tor a computer. This computer program allows the maximum flexibility in problem definition through selection of the variables in the mathematical model. Future similar problems can then be quickly solved by inputing specific variables. The program also allows the user to play "what if" games to analyze the effects of design changes before the actual changes are initiated. Finally ASEC develops ways to confirm the results to insure the computer solution predicts actual performance.

3.0 Detailed Test Plans and Procedure

All AFGL payloads are subjected to extensive ground testing to ensure their successful operational use. The extent of the testing is carefully determined by a tradeoff analysis between acceptable risk, fiscal cost and the impact of schedule changes.

Under this contract, ASEC has developed a comprehensive test program for AFGL. One of ASEC's specific responsibilities is to develop and publish detailed test plans and procedures. These plans and procedures are utilized in testing components and systems used in AFGL sounding probes. Table 2 is a listing and brief description of the 94 individual test plans and procedures developed by ASEC in the past year. Each test plan contains individual sections on the following:

- Test Objective
- Test Item Description
- Test Facility
- Test Requirement
- Test Support Equipment
- Test Set-up
- Test Description
- Pass/Fail Criteria
- Data Analysis and Evaluation Approach
- Test Report
- Schedule

Also attached to each test plan is an appendix containing the step by step procedures to be followed during the test.

3.1 Test Support Documentation

Table 3 is a listing of test support documentation developed by ASEC during this reporting period. The purpose of each of the documents is also in Table 3. All test documents listed in Tables 2 and 3 are in the ASEC test documentation library at AFGL and are available for review at anytime.

4.0 Engineering Field Support

In order to expand AFGL's capacity to manage the development of their scientific space probes, ASEC provides experienced engineers to support AFGL during field acceptance tests, safety reviews, planning conferences, payload integration at the launch site, prelaunch testing, launch and payload recovery. In this reporting period ASEC provided 18 man weeks of engineering field support accomplished in this period. Table 4 outlines the ASEC engineering field support provided.

5.0 Engineering Support for Design Reviews

During this reporting period AFGL has supported seven system design reviews. The purpose of these design reviews is to satisfy the AFGL customer, Space Division, that every feasible effort has been used in reducing the risk of failure in each space probe experiment. ASEC has made significant contributions to each of these design reviews. Table 5 lists the design reviews conducted and specific ASEC participation.

6.0 Equipment Fabrication

One option contained in the ASEC contract is for ASEC to assist AFGL by engineering and fabricating systems to support the space probe efforts. Under this option ASEC has assisted AFGL in the design/ fabrication of a mobile telemetry van and the design of a dummy payload used in parachute test flights. It is anticipated that more design and fabrication tasks will be assigned in the future. Table 6 contains the ASEC support provided in this reporting period.

7.0 Testing Fabricated Items

As part of the system engineering support provided ASEC has conducted or participated in 94 separate development, acceptance and prelaunch validation tests. After the test ASEC has also completely documented the test results in a detailed test report. The test report contains sections on the following.

- Test Summary
- Test Objective
- Test Description
- Test Results
- Conclusions and Recommendations

All test reports are approved and signed by the Test Conductor and are filed in the ASEC test documentation library along with the original test plan and a completed test procedure. Table 7 lists the tests and test reports completed during the first year of this contract.

8.0 Summary

During the first twelve months of the ASEC contract, ASEC has made significant system engineering contributions. These contributions have included engineering design, test, field engineering, equipment fabrication and development of program documentation. Progress is reported on a monthly basis and all documentation originated by ASEC is available for review in the ASEC documentation file at AFGL.

TABLE 1

TASK 1: ASEC ENGINEERING AND TEST ANALYSIS

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PROBLEM DEFINITION	MATH MODEL	INITIAL TESTING	COMPUTER MODEL	CONFIRMATION OF RESULTS
PROTECT HIGH VALUE SENSORS DURING RECOVERY GROUND IMPACT	ENERGY BALANCE AND FORCE EQUATIONS	AT WHITE SANDS MISSILE RANGE TO DETERMINE SUBGRADE MODULUS IN THE RECOVERY AREA AT AFGL AND LOWELL UNIVERSITY TO VERIFY ALUMINUM CRUSH PAD PROPERTIES	DEVELOPED MODEL WITH VARIABLES TO INCLUDE SUBGRADE MODULUS, CRUSH PAD STRENGTH, CRUSH PAD AREA, IMPACT VELOCITY, CRUSH PAD LENGTH, PAYLOAD MASS AND PAYLOAD AREA	CALCULATIONS AND COMPUTER PROGRAM VERIFIED THROUGH EXTENSIVE TESTING
DEVELOP COMPUTER MODEL TO PREDICT THE PRESSURE DIFFERENTIAL ACROSS THE PAYLOAD SKIN DURING THE ROCKET TRAJECTORY	USED THE PERFECT GAS LAW DIFFERENTIATE WITH RESPECT TO TIME, THEN ADDED A LOW PRESSURE CORRECTION AND A COMPRESSIBILITY CORRECTION	DETERMINED THE DISCHARGE COEFFICIENTS OF ALL VALVES AND FILTERS USED ON THE PAYLOAD	DEVELOPED WITH VARIABLES TO INCLUDE PAYLOAD VOLUME, ASCENT OR DESCENT VELOCITIES AND ALL COMBINATIONS OF VENTING VALVES	CALCULATIONS AND COMPUTER PROGRAM VERIFIED THROUGH TESTING AND THROUGH A DETAILED COMPARISON OF THE PREDICTED AND ACTUAL PRESSURES IN BOTH ZIP FLIGHTS
PREDICT THE PROBABILITY OF THE CRYSTALIZATION OF ATTITUDE CONTROL SYSTEM GASES WHEN VENTED THROUGH A NOZZLE INTO A VACUUM	THERMODYNAMIC CALCULATION, GAS FLOW EQUATIONS AND TEMPERATURE/ENTROPY RELATIONSHIPS FOR SELECTED GASES	INITIAL TESTS WERE CONDUCTED AT AFGL USING NOZZLES FABRICATED AT WENTWORTH INSTITUTE OF TECHNOLOGY VENTING INTO A VACUUM JAR	DEVELOPED WITH VARIABLES TO INCLUDE VARIABLE SYSTEM GEOMETRY, ANY GAS CHARACTERISTICS AND UNLIMITED MANUVER REQUIREMENTS	AN EXPERIMENT IS BEING DESIGNED TO VISUALLY CONFIRM THE PRESENTS OF CRYSTALIZATION PREDICTED BY THE PROGRAM
PREDICT ALTITUDE CONTROL SYSTEM GAS USAGE DURING A PROPOSED MISSION PROFILE	GAS EQUATIONS, CLIPPLING OF MAXIMUM SENSOR ANGULAR RATE DURING DEPLOYMENT, GAS FLOW EQUATIONS, COMPRESSIBILITY CORRECTIONS AND GAS CHARACTERISTICS	USED TEST RESULTS FROM SEVERAL AIR BEARING TESTS AT SPACE VECTOR CORPORATION	DEVELOPED WITH VARIABLES TO INCLUDE VARIABLE SYSTEM GEOMETRY, ANY GAS CHARACTERISTICS AND UNLIMITED MANUVER REQUIREMENTS	COMPUTER PROGRAM PREDICTIONS WILL BE COMPARED WITH ACTUAL USAGE IN FUTURE BMP FLIGHTS

TABLE 2

TASK 2: DETAILED TEST PLANS AND PROCEDURES

82 1381AF - A

TEST NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
100-1	IRBS	PAYLOAD SHOCK-LONG PULSE	ACCEPTANCE
100-2	IRBS	PAYLOAD SEAL VERIFICATION WITH ACS	ACCEPTANCE
100-3	IRBS	STRUCTURAL TEST	DEVELOPMENT
100-4	IRBS	PAYLOAD SEAL VERIFICATION (WITHOUT ACS)	ACCEPTANCE
100-5	IRBS	SYSTEM TEST WITHOUT ACS	PRELAUNCH VAL.
100-6	IRBS	SYSTEM TEST WITH ACS	PRELAUNCH VAL.
100-7	IRBS	PAYLOAD SHOCK AND VIBRATION	ACCEPTANCE
100-9	IRBS	PAD INTERFACE TEST	PRELAUNCH VAL.
150-1	IRBS	CRUSH PAD SHOCK, VIBRATION, VACUUM	ACCEPTANCE
150-2	IRBS	T.M. ELECTRONICS SUPPORT MTG-VIBRATION	ACCEPTANCE
150-3	IRBS	SENSOR COVER OPERATION	ACCEPTANCE
150-4	IRBS	CRUSH PAD STRUCTURAL TEST	ACCEPTANCE
150-5	IRBS	ASPECT DOOR DEVELOPMENT TEST	DEVELOPMENT
150-6	IRBS	ASPECT DOOR FUNCTIONAL TEST	ACCEPTANCE
150-7	IRBS	DIGITAL TIMER SHOCK AND VIBRATION	ACCEPTANCE
150-8	IRBS	DIGITAL TIMER THERMAL CYCLING	ACCEPTANCE
150-11	IRBS	T.M. BATTERIES THERMAL CYCLING	ACCEPTANCE
150-12	IRBS	LINK 1 ENCODER THERMAL CYCLING	ACCEPTANCE

TABLE 2

TASK 2: DETAILED TEST PLANS AND PROCEDURES (Cont.) 82-1381AF-B

TEST NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
150-13	IRBS	T.M. TRANSMITTERS, SHOCK AND VIBRATION	ACCEPTANCE
150-14	IRBS	LINK 1 ENCODER, SHOCK AND VIBRATION	ACCEPTANCE
150-15	IRBS	T.M. TRANSMITTERS, VACUUM	ACCEPTANCE
150-16	IRBS	INSTRUMENT BATTERIES, SHOCK AND VIB.	ACCEPTANCE
150 -17	IRBS	T.M. BATTERIES, FUNCTIONAL	ACCEPTANCE
150-18	IRBS	T.M. BATTERIES, SHOCK AND VIBRATION	ACCEPTANCE
150-19	IRBS	INSTRUMENT BATTERIES, FUNCTIONAL	ACCEPTANCE
05-1	IRBS	T.M. TRANSMITTERS, THERMAL	ACCEPTANCE
300-1	ZIP-2	SENSOR SHOCK AND VIBRATION	ACCEPTANCE
300-2	ZIP-2	STRUCTURAL SEAL TEST	ACCEPTANCE
300-3	ZIP-2	SYSTEM TEST WITH COLD SENSOR	PRELAUNCH VAL
300-4	ZIP-2	SPIN BALANCE	PRELAUNCH VAL
300-5	ZIP-2	PAYLOAD SHOCK AND VIBRATION	ACCEPTANCE
300-8	ZIP-2	COVER OPEN	PRELAUNCH VAL
300-9	ZIP-2	PAYLOAD FUNCTIONAL TEST	PRELAUNCH VAL
300-10	ZIP-2	PAD INTERFACE TEST	PRELAUNCH VAL
300-14	ZIP-2	ACS/STAR TRACKER SENSE	PRELAUNCH VAL
300-15	ZIP-2	ASPECT DOOR LATCH TEST	ACCEPTANCE

TABLE 2

TASK 2: DETAILED TEST PLANS AND PROCEDURES (Cont.) 82-1381AF-C

TEST NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
350-1	ZIP-2	TELEMETRY SECTION BATTERIES, FUNCTIONAL	ACCEPTANCE
350-2	ZIP-2	TELEMETRY BATTERIES, SHOCK AND VIBRATION	ACCEPTANCE
350-3	ZIP-2	TELEMETRY BATTERIES, THERMAL CYCLING	ACCEPTANCE
350-4	ZIP-2	LINK 3 T.L.M. TRANSMITTER, THERMAL	ACCEPTANCE
350-5	ZIP-2	LINK 3 T.L.M. TRANSMITTER, SHOCK AND VIB	ACCEPTANCE
350-6	ZIP-2	LINK 1 & 2 TRANSMITTERS, THERMAL	ACCEPTANCE
350-7	ZIP-2	LINK 1 & 2 TRANSMITTERS, SHOCK AND VIB.	ACCEPTANCE
350-8	ZIP-2	LINK 3 ENCODER, THERMAL CYCLING	ACCEPTANCE
350-9	ZIP-2	LINK 3 ENCODER, SHOCK AND VIBRATION	ACCEPTANCE
350-10	ZIP-2	LINK 1 & 2 ENCODERS, THERMAL CYCLING	ACCEPTANCE
350-11	ZIP-2	LINK 1 & 2 ENCODERS, SHOCK AND VIBRATION	ACCEPTANCE
350-12	ZIP-2	INSTRUMENT BATTERIES, FUNCTIONAL	ACCEPTANCE
350-13	ZIP-2	INSTRUMENT BATTERIES, SHOCK AND VIB.	ACCEPTANCE
350-14	ZIP-2	INSTRUMENT BATTERIES, THERMAL	ACCEPTANCE
350-15	ZIP-2	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE
350-16	ZIP-2	DIGITAL TIMERS, SHOCK AND VIBRATION	ACCEPTANCE
350-17	ZIP-2	LOGIC CONTROL UNIT, THERMAL	ACCEPTANCE
350-18	ZIP-2	LOGIC CONTROL UNIT, SHOCK AND VIBRATION	ACCEPTANCE

TABLE 2

TASK 2: DETAILED TEST PLANS AND PROCEDURES (Cont.) 82-12P1AF (

TEST NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
350-19	ZIP-2	AUX. ELECTRONICS BOXES, THERMAL	ACCEPTANCE
350-20	ZIP-2	AUX. ELECTRONICS BOXES, SHOCK AND VIB.	ACCEPTANCE
350-21	ZIP-2	T.L.M. TRANSMITTERS, VACUUM	ACCEPTANCE
350-22	ZIP-2	SEPARATION PYRO BATTERIES, FUNCTIONAL	ACCEPTANCE
350-23	ZIP-2	SEPARATION PYRO BATTERIES, SHOCK AND VIB	ACCEPTANCE
350-24	ZIP-2	SEPARATION PYRO BATTERIES, THERMAL	ACCEPTANCE
400-1	FIRSSE	SENSOR DOOR LATCH PRESSURE TEST	ACCEPTANCE
400-2	FIRSSE	STRUCTURAL SEAL TEST	ACCEPTANCE
400-3	FIRSSE	STRUCTURAL BEND TEST	ACCEPTANCE
400-4	FIRSSE	SYSTEM TEST WITH COLD SENSOR	PRELAUNCH VAL.
400-5	FIRSSE	SYSTEM FUNCTIONAL TEST (WARM SENSOR)	PRELAUNCH VAL.
400-6	FIRSSE	COVER OPEN TEST	PRELAUNCH VAL.
400-7	FIRSSE	PAYLOAD, SHOCK AND VIBRATION	ACCEPTANCE
400-10	FIRSSE	SENSOR ALIGNMENT	PRELAUNCH VAL.
400-11	FIRSSE	ACS/STAR TRACKER SENSE	PRELAUNCH VAL
400-12	FIRSSE	SPIN BALANCE	PRELAUNCH VAL.
400-14	FIRSSE	PAD INTERFACE	PRELAUNCH VAL
450-1	FIRSSE	TELEMETRY BATTERIES, FUNCTIONAL	ACCEPTANCE

TABLE 2

TASK 2: DETAILED TEST PLANS AND PROCEDURES (Cont.)

TEST NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
450-2	FIRSSE	T.M. BATTERIES, SHOCK AND VIBRATION	ACCEPTANCE
450-3	FIRSSE	T.M. BATTERIES, THERMAL CYCLING	ACCEPTANCE
450-4	FIRSSE	T.M. TRANSMITTERS, THERMAL CYCLING	ACCEPTANCE
450-5	FIRSSE	T.M. TRANSMITTERS, SHOCK AND VIBRATION	ACCEPTANCE
450-6	FIRSSE	T.M. TRANSMITTERS VACUUM	ACCEPTANCE
450-7	FIRSSE	STAR MAPPER ENVIRONMENT	ACCEPTANCE
450-8	FIRSSE	LINK 3 ENCODER, THERMAL CYCLING	ACCEPTANCE
450-9	FIRSSE	LINK 3 ENCODER, SHOCK AND VIBRATION	ACCEPTANCE
450-10	FIRSSE	LINK 1 & 2 ENCODERS, THERMAL	ACCEPTANCE
450-11	FIRSSE	LINK 1 & 2 ENCODERS, SHOCK VIBRATION	ACCEPTANCE
450-12	FIRSSE	INSTRUMENT BATTERIES, FUNCTIONAL	ACCEPTANCE
450-13	FIRSSE	INSTRUMENT BATTERIES, SHOCK AND VIB.	ACCEPTANCE
450-14	FIRSSE	INSTRUMENT BATTERIES, THERMAL	ACCEPTANCE
450-15	FIRSSE	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE
450-16	FIRSSE	DIGITAL TIMERS, SHOCK AND VIBRATION	ACCEPTANCE
450-17	FIRSSE	LOGIC CONTROL UNIT, THERMAL CYCLING	ACCEPTANCE
450-18	FIRSSE	LOGIC CONTROL UNIT, SHOCK AND VIBRATION	ACCEPTANCE
450-19	FIRSSE	AUX. ELECTRONICS BOXES, THERMAL	ACCEPTANCE

TABLE 2

TASK 2: DETAILED TEST PLANS AND PROCEDURES (Cont.) 82-1381AF-F

TEST NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
450-20	FIRSSE	AUX. ELECTRONICS BOXES, SHOCK AND VIB.	ACCEPTANCE
450-21	FIRSSE	FOCAL PLANE ASSY BOXES, THERMAL	ACCEPTANCE
450-22	FIRSSE	FOCAL PLANE ASSY BOXES, SHOCK AND VIB.	ACCEPTANCE
450-23	FIRSSE	OFF-GIMBAL ELECTRONICS, SHOCK AND VIB.	ACCEPTANCE

TABLE 3

82-1378AF

TASK 2: TEST SUPPORT DOCUMENTATION

DOCUMENT	PURPOSE
COUNTDOWN HANDBOOKS • ZIP-1 • ZIP-2 • IRBS • FIRSSE	USED TO STANDARDIZE PROCEDURES, ESTABLISH TIMING AND REDUCE THE RISK OF ERROR DURING THE LAUNCH SEQUENCE
TECHNICAL DATA HANDBOOKS • ZIP-1 • ZIP-2 • IRBS • FIRSSE	USED TO INTERPRET TELEMETRY SIGNALS DURING PAYLOAD TESTING AND DURING THE ACTUAL SCIENTIFIC MISSION
TEST MATRIX • ZIP-1 • ZIP-2 • IRBS • FIRSSE	PLANNING DOCUMENT TO OUTLINE THE ENTIRE PAYLOAD TESTING PROGRAM
DETAILED TEST HISTORY • ZIP-1 • ZIP-2 • IRBS • FIRSSE	USED TO OUTLINE COMPONENT TEST STATUS AND ASSIST IN CONFIGURATION MANAGEMENT

TABLE 4

TASK 3: ENGINEERING FIELD SUPPORT

82-1378AF

PAYLOAD	LOCATION	PERIOD	PURPOSE
ZIP-2	WSMR	AUGUST, 1980 3 WEEKS	PAYLOAD INTEGRATION, TEST, LAUNCH SUPPORT AND RECOVERY
IRBS	ACTON, MA	NOVEMBER, 1980 1 WEEK	ENVIRONMENTAL TEST SUPPORT
IRBS	WSMR	DECEMBER, 1980 2 WEEKS	PAYLOAD INTEGRATION, ALIGNMENT AND PRELAUNCH TESTING
IRBS	WSMR	JANUARY, 1981 2 WEEKS	PRELAUNCH TESTING. LAUNCH POSTPONED BECAUSE OF RANGE EQUIPMENT MAL-FUNCTION
IRBS	WSMR	FEBRUARY, 1981 1 WEEK	LAUNCH SUPPORT
IRBS	WSMR	FEBRUARY, 1981 1 WEEK	RECOVERY OF IRBS COMPONENTS
ZIP-2	ACTON, MA	MARCH, 1981 1 WEEK	ENVIRONMENTAL TEST SUPPORT
ZIP-2	WSMR	JUNE, 1981 2 WEEKS	PAYLOAD INTEGRATION ALIGNMENT AND PRELAUNCH TESTING
BAMM 2A	LOS ANGELES	JUNE, 1981 1 WEEK	PLANNING CONFERENCE
ZIP-2	WSMR	JULY, 1981 2 WEEKS	PRELAUNCH TEST, LAUNCH SUPPORT AND RECOVERY
SPACE SHUTTLE	SAN FRANCISCO	JULY, 1981 1 WEEK	SAFETY REVIEW
BAMM 2A	ROSWELL, N.M.	JULY, 1981 1 WEEK	BALLOON PARACHUTE TEST

TABLE 5

TASK 4: ENGINEERING SUPPORT FOR DESIGN REVIEWS 82-1380AF

PAYLOAD	PERIOD	PURPOSE	PARTICIPATION
ZIP-2	AUGUST, 1980	PRELAUNCH DESIGN REVIEW	PROVIDED TEST DOCUMENTATION, COUNTDOWN AND TECHNICAL DATA
IRBS	NOVEMBER, 1980	PRELAUNCH DESIGN REVIEW	PROVIDED TEST DOCUMENTATION, MALFUNCTION REPORTS, FINAL COUNTDOWNS, AND TECHNICAL DATA HANDBOOKS
IRBS	JANUARY, 1981	READINESS REVIEW	PROVIDED TEST DOCUMENTATION, MALFUNCTION REPORTS, TEST MATRICES, VIEWGRAPHS, ACCESS LISTS, COUNTDOWNS AND TECHNICAL DATA BOOK
IRBS	FEBRUARY, 1981	TECHNICAL REVIEW PANEL	COMPLETE DATA PACKAGE FOR PANEL REVIEWING IRBS FLIGHT
ZIP-2	APRIL, 1981	READINESS REVIEW	PROVIDED BRIEFING MATERIAL, COUNTDOWNS, MALFUNCTION REPORTS, TECHNICAL DATA HANDBOOKS, TEST DOCUMENTATION, AND ACTION ITEMS
BAMM 2A	MAY, 1981	READINESS REVIEW	PROVIDED AGENDA, BRIEFING MATERIALS, PARACHUTE ANALYSIS AND BRIEFING
BAMM 2A	JUNE, 1981	DESIGN REVIEW	ASSISTED LCC DURING DESIGN REVIEW IN LOS ANGELES
ZIP-2	JULY, 1981	LAUNCH READINESS REVIEW	PROVIDED BRIEFING MATERIALS AND A MALFUNCTION REPORT ADDENDUM PACKAGE

TABLE 6

82-1376AF

EQUIPMENT FABRICATION

PAYLOAD	PERIOD	DESCRIPTION
BAMM 2	MARCH–JUNE 1981	PLANNING AND DESIGN OF THE COMPONENT WIRING OF THE BALLOON SECTION MOBILE TELEMETRY VAN
BAMM 2	MARCH–MAY 1981	DESIGN AND PROVIDE ENGINEERING DRAWINGS OF THE DUMMY PAYLOAD USED IN SCHEDULED PARACHUTE TESTS

TABLE 7

TASK 6: TESTING FABRICATED ITEMS

82-1381AF-A

REPORT NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
100-1	IRBS	PAYLOAD SHOCK-LONG PULSE	ACCEPTANCE
100-2	IRBS	PAYLOAD SEAL VERIFICATION WITH ACS	ACCEPTANCE
100-3	IRBS	STRUCTURAL TEST	DEVELOPMENT
100-4	IRBS	PAYLOAD SEAL VERIFICATION (WITHOUT ACS)	ACCEPTANCE
100-5	IRBS	SYSTEM TEST WITHOUT ACS	PRELAUNCH VAL.
100-6	IRBS	SYSTEM TEST WITH ACS	PRELAUNCH VAL.
100-7	IRBS	PAYLOAD SHOCK AND VIBRATION	ACCEPTANCE
100-9	IRBS	PAD INTERFACE TEST	PRELAUNCH VAL.
150-1	IRBS	CRUSH PAD SHOCK, VIBRATION, VACUUM	ACCEPTANCE
150-2	IRBS	T.M. ELECTRONICS SUPPORT MTG-VIBRATION	ACCEPTANCE
150-3	IRBS	SENSOR COVER OPERATION	ACCEPTANCE
150-4	IRBS	CRUSH PAD STRUCTURAL TEST	ACCEPTANCE
150-5	IRBS	ASPECT DOOR DEVELOPMENT TEST	DEVELOPMENT
150-6	IRBS	ASPECT DOOR FUNCTIONAL TEST	ACCEPTANCE
150-7	IRBS	DIGITAL TIMER SHOCK AND VIBRATION	ACCEPTANCE
150-8	IRBS	DIGITAL TIMER THERMAL CYCLING	ACCEPTANCE
150-11	IRBS	T.M. BATTERIES THERMAL CYCLING	ACCEPTANCE
150-12	IRBS	LINK 1 ENCODER THERMAL CYCLING	ACCEPTANCE

TABLE 7

TASK 6: TESTING FABRICATED ITEMS (Cont.)

82-1381AF 8

REPORT NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
150-13	IRBS	T.M. TRANSMITTERS, SHOCK AND VIBRATION	ACCEPTANCE
150-14	IRBS	LINK 1 ENCODER, SHOCK AND VIBRATION	ACCEPTANCE
150-15	IRBS	T.M. TRANSMITTERS, VACUUM	ACCEPTANCE
150-16	IRBS	INSTRUMENT BATTERIES, SHOCK AND VIB.	ACCEPTANCE
150-17	IRBS	T.M. BATTERIES, FUNCTIONAL	ACCEPTANCE
150-18	IRBS	T.M. BATTERIES, SHOCK AND VIBRATION	ACCEPTANCE
150-19	IRBS	INSTRUMENT BATTERIES, FUNCTIONAL	ACCEPTANCE
05-1	IRBS	T.M. TRANSMITTERS, THERMAL	ACCEPTANCE
300-1	ZIP-2	SENSOR SHOCK AND VIBRATION	ACCEPTANCE
300-2	ZIP-2	STRUCTURAL SEAL TEST	ACCEPTANCE
300-3	ZIP-2	SYSTEM TEST WITH COLD SENSOR	PRELAUNCH VAL
300-4	ZIP-2	SPIN BALANCE	PRELAUNCH VAL
300-5	ZIP-2	PAYLOAD SHOCK AND VIBRATION	ACCEPTANCE
300-8	ZIP-2	COVER OPEN	PRELAUNCH VAL
300-9	ZIP-2	PAYLOAD FUNCTIONAL TEST	PRELAUNCH VAL
300-10	ZIP-2	PAD INTERFACE TEST	PRELAUNCH VAL
300-14	ZIP-2	ACS/STAR TRACKER SENSE	PRELAUNCH VAL
300-15	ZIP-2	ASPECT DOOR LATCH TEST	ACCEPTANCE

TABLE 7

TASK 6: TESTING FABRICATED ITEMS (Cont.) 82-138:AF-(

REPORT NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
350–1	ZIP–2	TELEMETRY SECTION BATTERIES, FUNCTIONAL	ACCEPTANCE
350–2	ZIP–2	TELEMETRY BATTERIES, SHOCK AND VIBRATION	ACCEPTANCE
350–3	ZIP–2	TELEMETRY BATTERIES, THERMAL CYCLING	ACCEPTANCE
350–4	ZIP–2	LINK 3 T.L.M. TRANSMITTER, THERMAL	ACCEPTANCE
350–5	ZIP–2	LINK 3 T.L.M. TRANSMITTER, SHOCK AND VIB.	ACCEPTANCE
350–6	ZIP–2	LINK 1 & 2 TRANSMITTERS, THERMAL	ACCEPTANCE
350–7	ZIP–2	LINK 1 & 2 TRANSMITTERS, SHOCK AND VIB.	ACCEPTANCE
350–8	ZIP–2	LINK 3 ENCODER, THERMAL CYCLING	ACCEPTANCE
350–9	ZIP–2	LINK 3 ENCODER, SHOCK AND VIBRATION	ACCEPTANCE
350–10	ZIP–2	LINK 1 & 2 ENCODERS, THERMAL CYCLING	ACCEPTANCE
350–11	ZIP–2	LINK 1 & 2 ENCODERS, SHOCK AND VIBRATION	ACCEPTANCE
350–12	ZIP–2	INSTRUMENT BATTERIES, FUNCTIONAL	ACCEPTANCE
350–13	ZIP–2	INSTRUMENT BATTERIES, SHOCK AND VIB.	ACCEPTANCE
350–14	ZIP–2	INSTRUMENT BATTERIES, THERMAL	ACCEPTANCE
350–15	ZIP–2	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE
350–16	ZIP–2	DIGITAL TIMERS, SHOCK AND VIBRATION	ACCEPTANCE
350–17	ZIP–2	LOGIC CONTROL UNIT, THERMAL	ACCEPTANCE
350–18	ZIP–2	LOGIC CONTROL UNIT, SHOCK AND VIBRATION	ACCEPTANCE

TABLE 7

TASK 6: TESTING FABRICATED ITEMS (Cont.)

REPORT NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
350-19	ZIP-2	AUX. ELECTRONICS BOXES, THERMAL	ACCEPTANCE
350-20	ZIP-2	AUX. ELECTRONICS BOXES, SHOCK AND VIB.	ACCEPTANCE
350-21	ZIP-2	T.L.M. TRANSMITTERS, VACUUM	ACCEPTANCE
350-22	ZIP-2	SEPARATION PYRO BATTERIES, FUNCTIONAL	ACCEPTANCE
350-23	ZIP-2	SEPARATION PYRO BATTERIES, SHOCK AND VIB.	ACCEPTANCE
350-24	ZIP-2	SEPARATION PYRO BATTERIES, THERMAL	ACCEPTANCE
400-1	FIRSSE	SENSOR DOOR LATCH PRESSURE TEST	ACCEPTANCE
400-2	FIRSSE	STRUCTURAL SEAL TEST	ACCEPTANCE
400-3	FIRSSE	STRUCTURAL BEND TEST	ACCEPTANCE
400-4	FIRSSE	SYSTEM TEST WITH COLD SENSOR	PRELAUNCH VAL.
400-5	FIRSSE	SYSTEM FUNCTIONAL TEST (WARM SENSOR)	PRELAUNCH VAL.
400-6	FIRSSE	COVER OPEN TEST	PRELAUNCH VAL.
400-7	FIRSSE	PAYLOAD, SHOCK AND VIBRATION	ACCEPTANCE
400-10	FIRSSE	SENSOR ALIGNMENT	PRELAUNCH VAL.
400-11	FIRSSE	ACS/STAR TRACKER SENSE	PRELAUNCH VAL.
400-12	FIRSSE	SPIN BALANCE	PRELAUNCH VAL.
400-14	FIRSSE	PAD INTERFACE	PRELAUNCH VAL.
450-1	FIRSSE	TELEMETRY BATTERIES, FUNCTIONAL	ACCEPTANCE

TABLE 7

TASK 6: TESTING FABRICATED ITEMS (Cont.)

82-1381AF-E

REPORT NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
450–2	FIRSSE	T.M. BATTERIES, SHOCK AND VIBRATION	ACCEPTANCE
450–3	FIRSSE	T.M. BATTERIES, THERMAL CYCLING	ACCEPTANCE
450–4	FIRSSE	T.M. TRANSMITTERS, THERMAL CYCLING	ACCEPTANCE
450–5	FIRSSE	T.M. TRANSMITTERS, SHOCK AND VIBRATION	ACCEPTANCE
450–6	FIRSSE	T.M. TRANSMITTERS VACUUM	ACCEPTANCE
450–7	FIRSSE	STAR MAPPER ENVIRONMENT	ACCEPTANCE
450–8	FIRSSE	LINK 3 ENCODER, THERMAL CYCLING	ACCEPTANCE
450–9	FIRSSE	LINK 3 ENCODER, SHOCK AND VIBRATION	ACCEPTANCE
450–10	FIRSSE	LINK 1 & 2 ENCODERS, THERMAL	ACCEPTANCE
450–11	FIRSSE	LINK 1 & 2 ENCODERS, SHOCK VIBRATION	ACCEPTANCE
450–12	FIRSSE	INSTRUMENT BATTERIES, FUNCTIONAL	ACCEPTANCE
450–13	FIRSSE	NSTRUMENT BATTERIES, SHOCK AND VIB.	ACCEPTANCE
450–14	FIRSSE	INSTRUMENT BATTERIES, THERMAL	ACCEPTANCE
450–15	FIRSSE	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE
450–16	FIRSSE	DIGITAL TIMERS, SHOCK AND VIBRATION	ACCEPTANCE
450–17	FIRSSE	LOGIC CONTROL UNIT, THERMAL CYCLING	ACCEPTANCE
450–18	FIRSSE	LOGIC CONTROL UNIT, SHOCK AND VIBRATION	ACCEPTANCE
450–19	FIRSSE	AUX. ELECTRONICS BOXES, THERMAL	ACCEPTANCE

TABLE 7

TASK 6: TESTING FABRICATED ITEMS (Cont.) 82-1381AF-F

REPORT NUMBER	PAYLOAD	DESCRIPTION	TYPE TEST
450-20	FIRSSE	AUX. ELECTRONICS BOXES, SHOCK AND VIB.	ACCEPTANCE
450-21	FIRSSE	FOCAL PLANE ASSY BOXES, THERMAL	ACCEPTANCE
450-22	FIRSSE	FOCAL PLANE ASSY BOXES, SHOCK AND VIB.	ACCEPTANCE
450-23	FIRSSE	OFF-GIMBAL ELECTRONICS, SHOCK AND VIB.	ACCEPTANCE

APPENDIX B

ASECR: 82 163

ENGINEERING SUPPORT SERVICES FOR AFGL SOUNDING ROCKETS AND ASSOCIATED PAYLOADS

CONTRACT F19628-80-C-0125
(CDRL SEG. NR. 103)
DI-S-3591 A/M

- INTERIM REPORT -

1 August 1981 - 31 July 1982

Prepared for:

AFGL/LCR
Sounding Rocket Branch
Analytical Systems Engineering Corporation

TABLE OF CONTENTS

		Page No.
1.0	INTRODUCTION	1
2.0	ENGINEERING AND TEST ANALYSIS	2
3.0	DETAILED TEST PLANS AND PROCEDURES	4
4.0	ENGINEERING FIELD SUPPORT	5
5.0	ENGINEERING SUPPORT FOR DESIGN REVIEWS	7
6.0	EQUIPMENT FABRICATION	9
7.0	SUBJECT FABRICATED ITEMS TO TESTING	11
8.0	SES PROGRAM SUPPORT	13
9.0	ASEC PARTICIPATION IN AFGL'S SETS-1	14
10.0	SUMMARY	15

LIST OF TABLES

SECTION	Table No.	Page No.
2.0	Table 1	16
3.0	Tables 2A, 2B	17
4.0	Table 3	21
5.0	Table 4	22
6.0	Table 5	23
7.0	Tables 6A, 6B	24
8.0	Tables 7, 8	26

1.0 INTRODUCTION

This is the Second Interim Technical Report on ASEC's contract to provide system engineering support to the Air Force Geophysics Laboratory (AFGL) Sounding Rocket Branch (LCR). It covers the period of performance from 1 August 1981 to 31 July 1982.

It has been a busy and fruitful year as attested to by the main body of the report. The overall activity has embraced work concerning rockets, balloons and the space shuttle.

ASEC has submitted monthly Research and Development Status Reports which outlined monthly progress in all contractual task areas.

The purpose of this Interim Technical Report is to aggregate the activity in our contractual areas and present it in a single document.

To accomplish this purpose, the presentation is made by specific task areas. The tasks discussed in this report are in the following order:

- Engineering and Test Analysis
- Detailed Test Plans and Procedures
- Engineering Field Support
- Engineering Support for Design Reviews
- Equipment Fabrication
- Testing Fabricated Items
- SES Program Support
- SETS - 1
- Summary

Detailed listings of documentation provided by ASEC during the course of task executions are provided in the tables in the latter pages of this report.

2.0 ENGINEERING AND TEST ANALYSIS

During this reporting period, work was continued on the thermal stress calculations for the Space Shuttle experiments. A computer program for predicting the pressure difference across Space Shuttle instrument volumes was written. A short experimental program to determine the appropriate discharge coefficient was completed. Analysis of ZIP-2 gas budget was conducted to determine the cause of the excessive gas usage during roll maneuvers. Preliminary assessment indicates that the low thrust pitch and yaw nozzles were operating during most of this portion of the flight profile.

Airflow tests were conducted during September on an eleven inch Millipore filter to verify airflow data obtained during the August tests. ASEC Technical Memorandum: 81-550 "Venting Performance of CW-19012C3 and CW-19022C3 MILLIPORE Filters" is the summary report on these airflow tests.

Table 1 lists the analysis performed in this task effort. ASEC also conducted vacuum flow tests on various diameter orifices to determine flow coefficients for venting in Space Shuttle experiments. Calculations of the temperature variation with time of the emulsion-stack Penetrating Particle Detector (CRL 258) were completed.

The following documents for SETS-1 were delivered:

1) Failure Mode and Effects Analysis (FMEA) dated 1 Oct 1981

2) Accident Risk Assessment Report (ARAR) dated 1 Oct 1981, delivered with slide presentation and twenty copies for general distribution

3) Accident Risk Assessment Report (ARAR), Revision 1, Phase III Review Dry Run dated 19 Oct 1981, delivered with slide presentation

Reviewed calculations to determine the TEM-3 launch date using the desired forward scatter angles and line of sight angles for the TEM-3 Sensor.

The results of the Space Shuttle venting experiments were incorporated into a design plot for estimating the venting required for a given volume payload. This design plot was submitted as a technical note to the American Institute of Aeronautics and Astronautics Journal of Spacecraft and Rockets.

An investigation of the NASA design criteria for space qualified pressure vessels was made. This study was in support of the design of the liquid He cryogenic tank design for new INFRARED telescope which could be flown on a Space Shuttle mission. Effort was then expended on the heat transfer calculations associated with the vapor cooling of the

vent pipe from a liquid helium dewar containers. ASEC attempted to improve upon the idealized calculation of heat transfer which is presented in the text CRYOGENICS by Scott. The initial tests using two small supersonic expansion nozzles did not show the theoretical temperature drop.

This program LAIRTS (Large Aperture IR Telescope System) work involved the derivation of equations describing helium at temperatures and pressures near its critical point. A study of the Joule - Thompson refrigerator for use in further reducing the liquid helium temperature was a continuing effort. Calculations were carried out for the design of a Throttable Supersonic Nozzle to cool helium from 6°K to 1.5°K through gas expansion, thus avoiding the requirement of super cooled liquid helium, to cool the Sensor focal plane.

Calculations were also made to determine the proper sizing of the piping for exhausting the nozzle to the vacuum pump. A bellows type needle valve was selected for throttling the helium flow upstream of the nozzle. Design of the nozzle and the exhaust line to the vacuum pump were completed. Two nozzles were fabricated for use during testing. Calculations which predicted the cooling expected during initial tests were completed. The initial tests were designed to record the cooling effect of the expansion nozzle using compressed helium gas exhausting into the atmosphere. Comparison of the experimental data with the theoretical calculations was expected to give confidence in the validity of the analysis. If the theoretical calculations were verified experimentally then the next step would be the fabrication of a vacuum vessel for a full scale experiment.

The experiments were carried out on a small supersonic nozzle using compressed helium gas which exhausted to the atmospheric. The temperature drop was very much less than predicted either because of boundary layer effects or the inability of the thermocouple to sense the actual temperature. An experimental apparatus was designed and built to test a supersonic nozzle using liquid helium. The liquid was swirled as it passed through the nozzle to reduce boundary layer build-up and to enhance the cooling by throwing liquid droplets through extremely turbulent flow downstream in the jet.

A computer program was written which calculated the temperature and pressure of the helium remaining in an adiabatic dewar during venting of the He vapor as a function of time. The program involved the numerical integration of a differential equation and required curve fits for internal energy, enthalpy and pressure as a function of temperature. These curves were developed from data on a Mollier diagram of helium. This program will be used in conjunction with a helium venting/heating program to predict the performance of the LAIRTS dewar.

The venting paper abstract submitted for the AIAA 6th Sounding Rocket Conference was accepted and preparation of the AIAA manuscript was completed by the end of this report period.

3.0 DETAILED TEST PLANS AND PROCEDURES, TASK 2

During this reporting period, the necessary test documentation for the BMP and Space Shuttle experiments was completed. A listing of these plans and procedures will be found in Tables 2A and 2B. Other accomplishments are presented below in the sequence of their completion:

- The FIRSSE Countdown H.
- A detailed Test History for the FIRSSE Component Acceptance tests. SPICE - 2 structural bend test plan.
- Various Test Plans, Test Reports, safety analysis and briefing documentation in support of SETs-1, were completed and delivered. (Table 7.)
- Preliminary Report, FIRSSE mission A24.7S2-2 dated 18 February 1982.
- SPICE-2 System Test Matrix
- SPICE-2 Component Test Matrix
- SPICE-2 Component Test History
- Documentation for the BAMM II Mission including Operational Plans, Technical Data Handbooks, RFI Tests, and the Final Countdown.
- BAMM II Operations Plan
- BAMM II Countdown
- Galileo Probe Operations Plan
- Galileo Probe Technical Data
- The final SPICE 2 Main Countdown and the final SPICE 2 Technical Data Handbook
- Preliminary Draft of the SES Interface Control Document

ASEC updated the revised working draft of the SES ICD and provided engineering support for the PDR which was held at AFGL on 8 June 1982.

During the remainder of the report period, ASEC generated the baseline ICD and made a limited distribution, for comments, to key participants. This was done in anticipation of the SES Technical Design Review which was scheduled early in the next report period.

4.0 ENGINEERING FIELD SUPPORT, TASK 3

During this reporting period, Mr. Roger Johnson provided Engineering Field Support during Safety Reviews of the Space Shuttle experiments at Lockheed.

A tabular listing of the Engineering Field Support will be found in Table 3.

- Two ASEC engineers went to Holloman AFB, N.M., to assist in balloon launches and to define the intercom requirements for the Mobile Balloon Trailer Complex. They also attended a BAMM 2A planning conference at Aerospace Corporation in Los Angeles, CA. ASEC installed the intercom system in the BAMM Science Trainer

- ASEC attended BAMM IIA Interface Control meetings in Los Angeles on 6 and 7 October.

- Provided engineering field support for the FIRSSE Payload Shock and Vibration Test at Action Environmental Testing Corporation (AETC) on 12 and 13 November.

- Attended a BAMM 2 A meeting at Grumman Aerospace Corporation in Los Angeles.

- Provided engineering field support during the final Prelaunch Testing, the Dress Rehearsal and the Launch of FIRSSE (4 Jan - 23 Jan 82).

- Provided engineering support during BAMM testing at Visidyne in Burlington.

- Participated in field testing of the BAMM 2 Control Trailer at the Visidyne facility.

- Attended the BAMM 2 Mission Readiness Review at SPACE DIVISION 31 March - 2 April.

- Two ASEC engineers assisted in the Shock and Vibration Tests, of the SPICE Payload at Acton on 14 April.

- Provided field engineering support for the BAMM 2 Balloon flight at Chico California - April/May 1982. Mr. K. Lyons was the Instrument Command Control Director and Project Coordinator during the flight. Mr. Roy Fox consultant under ASEC contract, provided parachute support for the BAMM FLIGHT.

- Participated in the dress rehearsal and launch countdown of TEM-3 (18-28 May). During the launch Mr. J. Boczenowski held the position of IR Scientist. The Mission was a success.

- Provided field engineering support for the high altitude balloon group during the period 1 June - 19 July 1982. While on this field trip, Mr. K. Lyons participated in four different balloon launches.

- In support of the scheduled July Launch of SPICE 2, ASEC published Technical Data Handbooks, Malfunction Report Handbooks and Final Countdowns.

- Provided engineering field support at WSMR for the initial SPICE 2 field trip (8 - 15 June).

- Provided field engineering support for the high altitude balloon group during the period 1 June - 19 July. On this trip Mr. K. Lyons was Test Conductor for the Galileo balloon launch.

- Assisted in the Pre-launch Testing, Dress Rehearsal and aborted Launch of SPICE 2 at WSMR during the period 6-16 July.

5.0 ENGINEERING SUPPORT FOR DESIGN REVIEWS, TASK 4

- Detailed Milestone Schedules for the BAMM 2 project were established and published. An overall listing of Engineering Support Documentation for Payload will be found in Table 4 and Table 2B.

- ASEC visited the Physical Sciences Laboratory for a BAMM 2A Platform Design Review at New Mexico State University in Las Cruces.

- Briefing materials were prepared for the MSMP Technical Design Review (TDR) scheduled for November.

- Attended a Technical Design Review held at AFGL on 3 November. The purpose of the review was to determine the status of all TEM-3 launch items. Major areas of discussion centered on the modifications since the TEM-2 flight and remaining activities required to be completed before the May Launch of TEM-3. ASEC participation included preparation of the Program Manager's portion of the Review, the preparation of Minutes and the assignment of Action Items.

- Participated in the FIRSSE Mission Readiness Review. ASEC responsibilities included the development, publication and distribution of the Design Review Handbook, the FIRSSE Countdown, the FIRSSE Technical Data Handbook and the Malfunction Handbook.

ASEC also worked on the following projects:

- Initial analysis of the financial status of the MSMP Program.

- Compilation of information for the MSMP Program Manager's Handbook.

- Development of the agenda for an MSMP TDR to be held on January 26 and 27 at AFGL.

- Development of an Interface Control Document for use in the design of a sensor for the BAMM 2A mission.

- Provided updated test matrices, Malfunction Reports and briefing aids for the FIRSSE Launch Readiness Review in Los Angeles.

- Developed program overview information and briefing aids for the MSMP Technical Design Review (TDR).

- Developed flight planning information for an IR Working Group Meeting in support of MSMP.

- Prepared material for presentation at the BAMM 2 Mission Readiness Review and the BAMM 2 pre-flight briefing
- MSMP Technical Management Review Material.
- Organized, developed briefing aids and provided engineering support for the BAMM 2 Mission Readiness Review.
- Prepared briefing material for the MSMP Mission Readiness Review.
- Prepared briefing material for the MSMP Launch Readiness Review
- Developed a Contract Work Unit diagram for MSMP. This diagram contains information on the Contract Work Unit, Contractor Tasks, and Contract Controls.
- Prepared documentation for the MSMP Launch Readiness Review and for the Brazilian BIME program.
- Developed technical documentation for the MSMP Launch Readiness Review.
- Provided complete System and Component Test documentation for the SPICE 2 Mission Readiness Review.
- Prepared Technical Data Handbooks, Countdowns, Malfunction Report Handbooks and Design Review Handbooks for the SPICE 2 Mission Readiness Review (26 May 1982)
- Updated the MSMP Program Plan
- Prepared Material for the SES PDR
- Prepared Material for the SPICE 2 Prelaunch Readiness Review
- Prepared BIME Program Plan for the scheduled launches during September
- Prepared material for the SPICE 2 Launch Readiness Review
- Updated the SES Interface Control Document
- Participated in HPTEM Final Requirements Conference and prepared Minutes from this conference

6.0 EQUIPMENT FABRICATION, TASK 5

During this reporting period ASEC assisted AFGL in planning the refurbishment of the BAMM 2 trailers.

A list of new fabrication projects will be found in Table 5.

ASEC worked on the design of a multi-mode communication system for the BAMM Mobile Trailer Complex. The system include voice annotation to data tapes, video recording, telephone hook-up and outside speakers.

ASEC also designed and installed a system for noise reduction in the Mobile Data Trailer.

The following items were also accomplished:

- Provided site for installation provisions for a PDP 11/44 computer in the BAMM trailer.
- Updated electrical wiring in the BAMM control trailer.
- Several peripherals for the computer were installed, secured and wired.
- The command system was installed and checked out.
- Data formatters and PCM equipment were mechanically installed and electrically connected.
- A wiring diagram was developed showing the location and interdependence of each piece of equipment.
- The uplink equipment for the radiometer and interferometer were also installed.
- Began work on the installation of an Intercom System which would provide communications for the BAMM Mobile Trailer Complex.
- Completed work on the installation of the PDP 11/44 computer and peripherals in the BAMM Control Trailer.
- Provided wiring diagrams for equipment installed in the BAMM trailers.
- Began work on three PCM encoders to be used on the next BAMM flight.
- Development of comprehensive wiring diagrams for the BAMM 2 Control Trailer.

- Completion of the installation and check out of the Intercom System designed by ASEC to provide communications for the BAMM Mobile Trailer Complex.

- Completed the wiring diagram for the BAMM Data Acquisition Van.

- Designed the expansion nozzle for the helium cooling experiment.

- Changed four intercom stations in the BAMM Trailer which included making 4-9 pin interconnect cables and rewiring for the new positions. Adjusted all intercoms for proper voice communications.

- Changed location of the BAMM 2 video terminal and rewired it to the PDP 11/44 computer.

- Designed and set up command patch panels for four High Altitude Balloon flights.

7.0 TESTING FABRICATED ITEMS

During this reporting period ASEC planned and conducted airflow tests on variable length Millipore filters to determine the effects of filter length on venting performance. The report on these tests is ASECTM: 81-483 "Venting Performance of CW-1902203 Millipore Filter".

A listing of Test Report documentation delivered in this report period will be found in Tables 6A and 6B.

Four pressure tests were performed on equipment used in the Space Shuttle experiments and many Space Shuttle Experiment test reports were prepared (Table 6A).

ASEC participated in numerous FIRSSE Acceptance & Prelaunch Tests and SETS-1 Acceptance tests and prepared the Test Reports.

The following support was also provided:

- Participated in integration testing of the BAMM 2 trailer at the Visidyne facility.
- Participated in the SPICE-2 Structural Bend Test 12 and 16 February.
- Participated in the Shock and Vibration testing of eight WIT Model 206 Digital Timers.
- Participated in Shock and Vibration testing on four ELK Digital Timers.
- Prepared Malfunction Report No. EB-21-54 on a Digital Timer Serial Number 011 which failed during testing on 19 February
- Digital Timers, Shock and Vibration Tests, for SPICE 2
- System Test (Cold Sensor) without ACS for SPICE 2
- Cover Open Test for SPICE 2
- Logic Box and Auxilary Electronics Boxed, Thermal Cycling for SPICE 2
- Completed a series of acceptance tests on the BAMM 2 Mobile Control Van.
- Participated in the integration and prelaunch testing of the BAMM 2 payload.

- Participated in the SPICE 2 acceptance testing including the Sensor deployment system, the Battery Shock and Vibration, Door Latch Pressure tests, Logic and Auxiliary Electronic Boxes Thermal Cycling, Payload Functional tests and the Payload Shock and Vibration Acceptance tests.

- Participated in the Integration and Prelaunch Testing of MSMP at WSMR.

- Conducted cooling tests on helium expansion nozzles.

- Participated in SPICE 2 testing on the Spare Logic and Auxiliary Electronics Boxes.

- Drafted the TEM-3 Quick Look Report

- Prepared SPICE 2 Malfunction Reports

- Completed SPICE 2 Prelaunch Validation Test Reports

8.0 SES PROGRAM SUPPORT

The Sensor Ejection System (SES) is the name for a new Rocket probe which is sponsored by the Space Division and which is being managed by AFGL/LCR with multi-contractor support.

The kick-off meeting for this project was held at AFGL. on 17 March 1982. The most immediate task, that of generating an Interface Control Document (ICD) by 1 April 1982, was assigned to ASEC. A preliminary working draft was prepared by 31 March 1982. This document was briefly discussed at an SES project meeting at AFGL on 20 April 1982. It was then expected that the ICD would be updated at approximately six week intervals until it is accepted in a final form.

At an SES project meeting at AFGL on 13 May 1982, it was stated that an update of the ICD was required prior to the Preliminary Design Review which was scheduled for 8 June 1982. ASEC prepared a revised working draft of the ICD which was reviewed by key participants on 25 May 1982.

9.0 ASEC PARTICIPATION IN AFGL'S SETS-1

In early 1981 AFGL was given a go-ahead to fly five experiments in Columbia scheduled for March 1982. These experiments were developed by AFGL scientists in which final results could only be attained in deep space conditions. Although AFGL is part of the Air Force, its personnel are not familiar with MIL specs, Air Force procedures and the complex procedures governing non-metallic materials in deep space.

Since flying and operating the experiments would be invaluable to AFGL scientists, AFGL appointed a project coordinator for the SETS'-1 experimental package (Mr. Raymond E. Wilton, AFGL/LCR) who promptly set about acquiring a budget and a library of resources to activate the experiments in the space environment. One of the most formidable problems was safety, not only for the individual experiments but also for the pilots and the space shuttle itself.

Safety involved four major considerations, namely fire, electric shock, contamination (outgassing) and collision (parts breaking loose and damaging equipment or the shuttle). Thus, safety would involve a number of engineering disciplines such as electrical and electronic, cryogenics, shearing and compressive stress, inorganic chemistry and hazards evaluation.

Mr. Wilton promptly turned to ASEC for the engineering assistance he would need to resolve the multitude of problems which immediately rose in the safety area for all experiments.

ASEC assigned personnel who started an immediate analysis of all the varied compounds utilized throughout the various hardware items making up each experiment. A stress analysis was also started to ascertain effects of high-g forces on the components used in the individual experiments.

The net result of all these efforts by various ASEC personnel were two comprehensive documents called the Accident Risk Assessment Report and the Failure Mode and Effects Analysis, both of which were accepted by NASA (owner of the shuttle) and the Air Force as proof that the experiments could fly in perfect safety.

Subsequently, all experiments flew in the Columbia and returned during 1982 with zero safety problems.

This entire program started very quickly and had a number of constraints placed on it by the rapidity necessary to gather the information and establish the safety aspects well in advance of liftoff of the Columbia. All this was accomplished with no delay in the overall Columbia flight from any AFGL experiments.

10.0 SUMMARY

As demonstrated in the body of the report, ASEC has made significant system engineering contributions during these past twelve months. The work has been both varied and interesting. It has run the gamut from detailed engineering analysis to the review of malfunction reports.

ASEC wishes to take this opportunity to thank the dedicated AFGL scientists and engineers with whom it has interfaced during this reporting period and without whom this activity would not have been possible.

TABLE 1

TASK 1: ENGINEERING AND TEST ANALYSIS

PROBLEM DEFINITION	MATH MODEL	PROGRESS OF INVESTIGATION
ZIP-2 GAS BUDGET	GAS FLOW EQUATIONS, COMPRESSIBILITY CORRECTIONS AND GAS CHARACTERISTICS	DURING AUGUST 1981 A ALYSIS OF THE ZIP-2 GAS BUDGET WAS CONDUCTED TO DETERMINE THE CAUSE OF THE EXCESSIVE GAS USAGE DURING ROLL MANUEVERS. PRELIMINARY ASSESSMENT INDICATED THAT THE LOW THRUST PITCH AND YAW NOZZLES WERE OPERATING DURING MOST OF THIS PORTION OF THE FLIGHT PROFILE.
VENTING AIR FLOW THROUGH FILTERS	SIMPLE ORIFICE FLOW. REFERENCE ZIP VENTING STUDIES	DURING SEPT..BER 1981 ASEC CONDUCTED AIRFLOW TESTS ON AN ELEVEN INCH MILLIPORE FILTER TO VERIFY AIRFLOW DATA OBTAINED DURING AUGUST TESTS. ASECTM: 81-550 "VENTING PERFORMANCE OF CW-19012C3 AND CW-19022C3 MILLIPORE FILTERS" IS THE SUMMARY REPORT ON THESE AIRFLOW TESTS.
SPACE SHUTTLE (SETS-1) PACKAGE VENTING	SIMPLE ORIFICE FLOW THROUGH HOLES IN INSTRUMENT PACKAGES	IN THE PERIOD AUGUST THROUGH NOVEMBER 1981 VARIOUS SIZED ORIFICES FOR VENTING SPACE SHUTTLE PAYLOADS DURING ASCENT WERE TESTED. THE RESULTS OF THE VENTING EXPERIMENTS WERE INCORPORATED INTO A DESIGN PLOT FOR ESTIMATING THE VENTING HOLES REQUIRED FOR A GIVEN VOLUME.
STUDY OF HELIUM VENTING FROM DEWARS FOR SUPER COOLING He	EQUATIONS FOR HELIUM AT TEMPS AND PRESSURES NEAR THE CRITICAL POINT	DURING THE PERIOD DECEMBER 1981 THROUGH JULY 1982 STUDIES WERE MADE TO DEVELOP A NOZZLE WHICH WOULD COOL HELIUM FROM $6^{o}K$ TO $1.5^{o}K$ THROUGH GAS EXPANSION. TESTS OF TWO NOZZLES SHOWED A TEMPERATURE DROP MUCH LESS THAN THEORY WOULD INDICATE. THIS INVESTIGATION WILL BE CONTINUED IN THE NEXT REPORTING PERIOD.

TABLE 2A

TASK 2: DETAILED TEST PLANS AND PROCEDURES

TEST NUMBER	PAYLOAD	TEST DESCRIPTION	TEST TYPE	PLAN START	PLAN RELEASE
400-5	FIRSSE	SYSTEM FUNCTIONAL TEST (WARM SENSOR)	PRELAUNCH VALIDATION	AUG 1981	SEP 1981
400-6	FIRSSE	COVER OPEN TEST	PRELAUNCH VALIDATION	------	AUG 1981
400-7	FIRSSE	PAYLOAD SHOCK AND VIBRATION TEST	ACCEPTANCE	AUG 1981	SEP 1981
400-12	FIRSSE	SPIN BALANCE	PRELAUNCH VALIDATION	------	SEP 1981
400-14	FIRSSE	PAD INTERFACE TEST	PRELAUNCH VALIDATION	------	SEP 1981
450-19	FIRSSE	AUXILIARY ELECTRONICS BOXES, THERMAL CYCLING	ACCEPTANCE	------	AUG 1981
450-21	FIRSSE	FOCAL PLAN ASSEMBLY BOXES, THERMAL CYCLING	ACCEPTANCE	SEP 1981	NOV 1981
500-1	SPICE 2	STRUCTURE SEAL TEST	ACCEPTANCE	------	MAR 1982
500-3	SPICE 2	STRUCTURE BEND TEST	ACCEPTANCE	------	FEB 1982
500-4	SPICE 2	SYSTEM TEST (COLD SENSOR)	PRELAUNCH VALIDATION	------	MAR 1982
500-5	SPICE 2	PAYLOAD FUNCTIONAL TEST (WARM SENSOR)	PRELAUNCH VALIDATION	------	MAR 1982
500-6	SPICE 2	PAYLOAD SHOCK AND VIBRATION TEST	ACCEPTANCE	JAN 1982	APR 1982
500-7	SPICE 2	ACS/STAR TRACKER SENSE TEST	PRELAUNCH VALIDATION	APR 1982	JUN 1982
500-8	SPICE 2	COVER OPEN TEST	PRELAUNCH VALIDATION	JAN 1982	MAR 1982
500-9	SPICE 2	PAYLOAD SPIN BALANCE	PRELAUNCH VALIDATION	APR 1982	JUN 1982
500-10	SPICE 2	PAD INTERFACE TEST	PRELAUNCH VALIDATION	MAY 1982	JUN 1982

TABLE 2A
TASK 2: DETAILED TEST PLANS AND PROCEDURES (CONT.)

TEST NUMBER	PAYLOAD	TEST DESCRIPTION	TEST TYPE	PLAN START	PLAN RELEASE
550-1	SPICE 2	SUPPORT/ASPECT SECTION MOTORS, VACUUM	ACCEPTANCE	MAY 1981	SEP 1981
550-2	SPICE 2	ENCODERS, SHOCK AND VIBRATION TEST	ACCEPTANCE	FEB 1982	MAR 1982
550-6	SPICE 2	SUPPORT SECTION BATTERIES, FUNCTIONAL	ACCEPTANCE	FEB 1982	FEB 1982
550-7	SPICE 2	SUPPORT SECTION BATTERIES, THERMAL	ACCEPTANCE	SEP 1981	FEB 1982
550-8	SPICE 2	SUPPORT SECTION BATTERIES, SHOCK & VIBRATION	ACCEPTANCE	SEP 1981	FEB 1982
550-9	SPICE 2	AUZILIARY ELECTRONICS BOXES, THERMAL	ACCEPTANCE	SEP 1981	APR 1982
550-10	SPICE 2	ELECTRONICS BOXES, SHOCK & VIBRATION	ACCEPTANCE	SEP 1981	APR 1982
550-11	SPICE 2	LOGIC CONTROL UNIT, THERMAL CYCLING	ACCEPTANCE	SEP 1981	MAR 1982
550-12	SPICE 2	LOGIC CONTROL UNIT, SHOCK & VIBRATION	ACCEPTANCE	SEP 1981	APR 1982
550-13	SPICE 2	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE	JAN 1982	FEB 1982
550-14	SPICE 2	DIGITAL TIMERS, SHOCK & VIBRATION	ACCEPTANCE	JAN 1982	MAR 1982

TABLE 2A
TASK 2: DETAILED TEST PLANS AND PROCEDURES (CONT.)

TEST NUMBER	PAYLOAD	TEST DESCRIPTION	TEST TYPE	PLAN START	PLAN RELEASE
650-9	ELK	PCM ENCODERS, SHOCK AND VIBRATION	ACCEPTANCE	------	JUN 1982
650-10	ELK	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE	------	JUN 1982
650-11	ELK	DIGITAL TIMERS, SHOCK AND VIBRATION	ACCEPTANCE	------	JUN 1982
650-12	ELK	SUPPORT BATTERIES, FUNCTIONAL	ACCEPTANCE	------	JUN 1982
650-13	ELK	SUPPORT BATTERIES, TEMPERATURE	ACCEPTANCE	------	JUN 1982
650-14	ELK	SUPPORT BATTERIES, SHOCK AND VIBRATION	ACCEPTANCE	------	JUN 1982
650-15	ELK	LOGIC CONTROL UNIT, THERMAL CYCLING	ACCEPTANCE	------	JUN 1982
650-16	ELK	LOGIC CONTROL UNIT, SHOCK AND VIBRATION	ACCEPTANCE	------	JUN 1982
650-17	ELK	AUX. ELECTRONICS BOXES, THERMAL CYCLING	ACCEPTANCE	------	JUN 1982
650-18	ELK	AUX. ELECTRONICS BOXES, SHOCK & VIBRATION	ACCEPTANCE	------	JUN 1982

TABLE 2B

TASK 2: TEST SUPPORT DOCUMENTATION

DOCUMENT	PURPOSE
TEST MATRIX	
• FIRSSE • SPICE-2	PLANNING DOCUMENT TO OUTLINE THE ENTIRE PAYLOAD TESTING PROGRAM
DETAILED TEST HISTORY	
• FIRSSE • SPICE-2	USED TO OUTLINE COMPONENT TEST STATUS AND ASSIST IN CONFIGURATION MANAGEMENT
TECHNICAL DATA HANDBOOKS	
• FIRSSE • BAMM 2 • SPICE-2	USED TO INTERPRET TELEMETRY SIGNALS DURING PAYLOAD TESTING AND DURING THE ACTUAL SCIENTIFIC MISSION
COUNTDOWN HANDBOOKS	
• FIRSSE • BAMM 2 • SPICE-2	USED TO STANDARDIZE PROCEDURES, ESTABLISH TIMING AND REDUCE THE RISK OF ERROR DURING THE LAUNCH SEQUENCE

TABLE 3

TASK 3: ENGINEERING FIELD SUPPORT

PAYLOAD	LOCATION	PERIOD	PURPOSE
SETS-1	SUNNYVALE, CA	AUG & OCT 1981	SAFETY REVIEWS OF SPACE SHUTTLE EXPERIMENTS AT LOCKHEED.
BAMM-2A	HOLLOMAN, N.M. LOS ANGELES, CA	SEPTEMBER 1981	ASSIST IN BALLOON LAUNCHES IN N.M. AND TO ATTEND A PLANNING CONFERENCE AT AEROSPACE CORP.
BAMM-2A	LOS ANGELES, CA	OCTOBER 1981	INTERFACE CONTROL AND PLANNING CONFERENCE.
FIRSSE	ACTON, MA	12,12,NOV 1981	PAYLOAD SHOCK AND VIBRATION TESTS AT ACTON ENVIRONMENTAL TEST CORP.
BAMM-2A	IRVINE, CA	NOVEMBER 1981	PLANNING CONFERENCE AT GRUMMAN AEROSPACE
FIRSSE	WHITE SANDS MISSILE RANGE	DECEMBER 1981	PAYLOAD INTEGRATION AND PRELAUNCH SYSTEM TESTING.
FIRSSE	WSMR	JANUARY 1982	FINAL PRELAUNCH TESTING, DRESS REHEARSAL, LAUNCH AND RECOVERY.
BAMM-2	BURLINGTON, MA	JAN/FEB 1982	WIRING DIAGRAM - PAYLOAD INTEGRATION - PRELAUNCH TESTING AT VISIDYNE CO.
BAMM-2	LOS ANGELES	MAR/APR 1982	MISSION READINESS REVIEW AT SPACE DIVISION.
BAMM-2	CHICO, CA	APRIL 1982	PRELAUNCH TEST, LAUNCH SUPPORT AND RECOVERY PARACHUTE SUPPORT*
SPICE-2	ACTON, MA	21 APRIL 1982	PAYLOAD SHOCK AND VIBRATION TESTS.
TEM-3	WSMR	MAY 1982	PAYLOAD INTEGRATION, DRESS REHEARSAL AND LAUNCH COUNTDOWN.
GALILEO	ROSWELL, N.M.	JUN/JUL 1982	PRELAUNCH TEST, LAUNCH SUPPORT AND RECOVERY-FOUR HIGH-ALTITUDE BALLOONS.
SPICE-2	WSMR	JUNE 1982	INITIAL PAYLOAD PRELAUNCH TESTING AND INTEGRATION.
SPICE-2	WSMR	JULY 1982	ASSISTED IN TESTING, DRESS REHEARSAL AND ABORTED LAUNCH.

*Consultant Roy Fox provided parachute support for BAMM-2 Mission.

TABLE 4

TASK 4: ENGINEERING SUPPORT FOR TECHNICAL REVIEWS

PAYLOAD	PERIOD	PURPOSE	PURPOSE
BAMM-2A	OCTOBER 1981	PRELIMINARY DESIGN REVIEW	PROVIDED MATERIAL FOR INTERFACE CONTROL MEETING IN LOS ANGELES
BAMM-2A	NOVEMBER 1981	DESIGN REVIEW	ASSISTED LCC DRING DESIGN REVIEW IN IRVINE CALIFORNIA
TEM-3	NOVEMBER 1981	TECHNICAL DESIGN REVIEW	PROVIDED BRIEFING MATERIAL, PREPARED MINUTES, AND ASSIGNED ACTION ITEMS.
FIRSSE	NOVEMBER 1981	MISSION READINESS REVIEW	PROVIDED DESIGN REVIEW HANDBOOK, LAUNCH COUNTDOWN, TECHNICAL DATA HANDBOOK, AND MALFUNCTION HANDBOOK.
TEM-3	JANUARY 1982	TECHNICAL DESIGN REVIEW	PROVIDED AGENDA, PROGRAM OVERVIEW AND OTHER BRIEFING AIDS PLUS A PROGRAM MANAGERS HANDBOOK.
FIRSSE	JANUARY 1982	LAUNCH READINESS REVIEW	PROVIDE UPDATED TEST MATRICES, MALFUNCTION REPORTS AND BRIEFING AIDS
BAMM-2	MARCH 1982	MISSION READINESS REVIEW	PROVIDED BRIEFING MATERIAL, COUNTDOWN, TECHNICAL DATA HANDBOOK, AND RFI TESTS.
MSMP	MARCH 1982	TECHNICAL MANAGEMENT REVIEW	PREPARED BRIEFING AND UPDATED TASK AND WORK UNIT FOLDERS.
TEM-3	MAY 1982	LAUNCH READINESS REVIEW	PROVIDED BRIEFING AND TECHNICAL DOCUMENTATION.
SPICE-2	MAY 1982	MISSION READINESS REVIEW	PROVIDED MALFUNCTION REPORT BOOKS, COUNTDOWNS, TECHNICAL DATA BOOKS, DESIGN REVIEW HANDBOOKS, AND COMPLETE TEST DOCUMENTATION
SES	JUNE 1982	PRELIMINARY DESIGN REVIEW	PROVIDED REVISED DRAFT OF I.C.D. AND MEETING MINUTES.

TABLE 5

TASK 5: EQUIPMENT FABRICATION

PAYLOAD	PERIOD	DESCRIPTION
BAMM 2	SEP 81 - FEB 82	DESIGN AND INSTALLATION OF A MULTI-MODE COMMUNICATION SYSTEM FOR THE BAMM MOBILE TRAILER COMPLEX.
BAMM 2	JANUARY 1982	BEGAN DESIGN AND FABRICATION WORK ON THREE PCM ENCODER PACKAGES TO BE USED ON BAMM FLIGHTS.

TABLE 6A

FIRSSE TEST REPORTS

TASK 6: TESTING FABRICATED ITEMS

TEST NUMBER	PAYLOAD	TEST DESCRIPTION	TEST TYPE	TEST DATE (S)	REPORT DATE
400-2	FIRSSE	STRUCTURAL SEAL TEST	ACCEPTANCE	JAN 1982	JAN 1982
400-4	FIRSSE	SYSTEM TEST WITH COLD SENSOR	PRELAUNCH VAL.	DEC 1981 JAN 1982	JAN 1982
400-5	FIRSSE	SYSTEM FUNCTIONAL TEST (WARM SENSOR)	PRELAUNCH VAL.	OCT/DEC81	JAN 1982
400-6	FIRSSE	COVER OPEN TEST	PRELAUNCH VAL.	OCT/DEC81	JAN 1982
400-7	FIRSSE	PAYLOAD SHOCK AND VIBRATION TEST	ACCEPTANCE	13 NOV 81	23 NOV 81
400-11	FIRSSE	ACS/STAR TRACKER, SENSE TEST	PRELAUNCH VAL.	17 DEC 81	JAN 1982
400-12	FIRSSE	SPIN BALANCE (WSMR)	PRELAUNCH VAL.	9-11 DEC81	JAN 1982
400-14	FIRSSE	PAD INTERFACE TEST	PRELAUNCH VAL.	12-14 DEC81	JAN 1982
450-7	FIRSSE	STAR MAPPER-THREE ENVIRONMENTS TESTS	ACCEPTANCE	SEP 1981	NOV 1981
450-8	FIRSSE	LINK 3 ENCODER, THERMAL CYCLING	ACCEPTANCE	2-12 NOV81	NOV 1981
450-9.1	FIRSSE	LINK 3 ENCODER, SHOCK, & VIBRATION TEST	ACCEPTANCE	16 NOV 81	NOV 1981
450-11	FIRSSE	LINK 1 & 2 ENCODERS, SHOCK & VIBRATION	ACCEPTANCE	OCT/NOV 81	NOV 1981
450-15	FIRSSE	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE	JUL 1981	NOV 1981
450-16	FIRSSE	DIGITAL TIMERS, SHOCK & VIBRATION TEST	ACCEPTANCE	AUG 1981	NOV 1981
450-17	FIRSSE	LOGIC CONTROL UNIT, THERMAL CYCLING	ACCEPTANCE	JUN 1981	NOV 1981
450-18	FIRSSE	LOGIC CONTROL UNIT, SHOCK & VIBRATION	ACCEPTANCE	JUL 1981	NOV 1981
450-19	FIRSSE	A/X. ELECTRONICS BOXES, THERMAL CYCLING	ACCEPTANCE	JUN 1981	NOV 1981
450-20	FIRSSE	A/X. ELECT. BOXES, SHOCK & VIBRATION	ACCEPTANCE	JUL 1981	NOV 1981
450-21	FIRSSE	FOCAL PLANE ASSY BOXES, THERMAL CYCLING	ACCEPTANCE	9-11 NOV 81	NOV 1981
450-22	FIRSSE	FOCAL PLANE ASSY BOXES, SHOCK & VIBRATION	ACCEPTANCE	7 AUG 81	OCT 1981
450-23	FIRSSE	OFF-GIMBAL ELECTRONICS, SHOCK & VIBRATION	ACCEPTANCE	17 AUG 81	NOV 1981

TABLE oB

SPICE 2 TEST REPORTS

NUMBER	PAYLOAD	TEST DESCRIPTION	TEST TYPE	TEST DATE (S)	REPORT DATE
500-2	SPICE 2	STRUCTURE SEAL TEST	ACCEPTANCE	JUL 1982	JUL 1982
500-3	SPICE 2	STRUCTURE BEND TEST	ACCEPTANCE	FEB 1982	MAR 1982
500-4	SPICE 2	SYSTEM TEST (COLD SENSOR)	PRELAUNCH VALIDATION	APR/JUN 82	APR/JUL 82
500-5	SPICE 2	PAYLOAD FUNCTIONAL TEST (WARM SENSOR)	PRELAUNCH VAL.	APR/JUN 82	MAY/JUN 82
500-6	SPICE 2	PAYLOAD SHOCK AND VIBRATION TEST	ACCEPTANCE	APR 1982	APR 1982
500-7	SPICE 2	ACS/STAR TRACKER SENSE TEST	PRELAUNCH VAL.	JUN 1982	JUL 1982
500-8	SPICE 2	COVER OPEN TEST	PRELAUNCH VAL.	MAR/JUN 82	MAY/JUL 82
500-9	SPICE 2	PAYLOAD SPIN BALANCE	PRELAUNCH VAL.	JUN/JUL 82	JUL 1982
500-10	SPICE 2	PAD INTERFACE TEST		JUN/JUL 82	JUL SEP 82
550-1	SPICE 2	SUPPORT/ASPECT SECT. MOTORS, VACUUM	ACCEPTANCE	SEP 1981	JUN 1981
550-5	SPICE 2	ENCODERS, SHOCK AND VIBRATION TEST	ACCEPTANCE	MAR 1982	APR 1982
550-6	SPICE 2	SUPPORT SECTION BATTERIES, FUNCTIONAL	ACCEPTANCE	MAY 1982	MAY 1982
550-7	SPICE 2	SUPPORT SECTION BATTERIES, THERMAL	ACCEPTANCE	OCT81-MAY82	MAY 1982
550-8	SPICE 2	SUPPORT SEC. SATTS, SHOCK & VIBRATION	ACCEPTANCE	SEP81-JUN82	JUN 1982
550-9	SPICE 2	AUXILIARY ELECTR. BOXES, SHOCK & VIBR.	ACCEPTANCE	APR 1982	MAY 1982
550-10	SPICE 2	AUX. ELECTRONICS BOXES, SHOCK & VIBR.	ACCEPTANCE	APR 1982	MAY 1982
550-11	SPICE 2	LOGIC CONTROL UNIT, THERMAL CYCLING	ACCEPTANCE	APR 1982	MAY 1982
550-12	SPICE 2	LOGIC CONTROL UNIT, SHOCK & VIBR.	ACCEPTANCE	MAY 1982	MAY 1982
550-13	SPICE 2	DIGITAL TIMERS, THERMAL CYCLING	ACCEPTANCE	MAR 1982	MAY 1982
550-14	SPICE 2	DIGITAL TIMERS, SHOCK & VIBRATION	ACCEPTANCE	MAR 1982	MAY 1982

TABLE 7

TASK 2: TEST PLANS FOR SETS-1

TEST NO.	DESCRIPTION
TP 801A-1	SETS-1 ACCEPTANCE TEST PLAN, AFGL 801A VIBRATION TEST
TP 801A-2	SETS-1 ACCEPTANCE TEST PLAN, AFGL 801A PRESSURE TEST
TP 801A-3	SETS-1 ACCEPTANCE TEST PLAN, AFGL 801A THERMAL CYCLING TEST
TP 801A-8	SETS-1 ACCEPTANCE TEST PLAN, AFGL 801A THERMAL-VACUUM TEST
TP 804A-1	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804A VIBRATION TEST
TP 804A-2	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804A PRESSURE TEST
TP 804A-2A	AFGL 804A PRESSURE TEST (SEAL)
TP 804A-3	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804A THERMAL CYCLING TEST
TP 804A-3A	SETS-1 ACCEPTANCE TEST PLAN, COVER MECHANISM THERMAL CYCLING TEST
TP 804A-8	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804A THERMAL-VACUUM TEST
TP 804B-1	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804B VIBRATION TEST
TP 804B-2	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804B PRESSURE TEST

TABLE 7

TASK 2: TEST PLANS FOR SETS-1 (CONT.)

TEST NO.	DESCRIPTION
TP 804B-3	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804B THERMAL CYCLING TEST
TP 804B-8	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804B THERMAL VACUUM TEST
TP 804C-1	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804C VIBRATION TEST
TP 804C-2	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804C PRESSURE TEST
TP 804C-3	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804C THERMAL CYCLING TEST
TP 804C-8	SETS-1 ACCEPTANCE TEST PLAN, AFGL 804C THERMAL VACUUM TEST
TP CRL-258-1	SETS-1 ACCEPTANCE TEST PLAN, CRL-258 VIBRATION TEST
TP CRL-258-2	SETS-1 ACCEPTANCE TEST PLAN, CRL-258 PRESSURE TEST
TP CRL-258-2.2	CRL-258 PRESSURE TEST (LONG DURATION VACUUM)
TP CRL-258-3	SETS-1 DEVELOPMENT TEST PLAN CRL-258 TEMPERATURE TEST
TP CRL-258-8	CRL-258 THERMAL-VACUUM TEST

TABLE 8

TASK 6: TEST REPORTS FOR SETS-1

TEST NO.	DESCRIPTION
TR 801A-1	AFGL 801A VIBRATION TEST
TR 801A-2	AFGL 801A PRESSURE TEST (ASCENT/ENTRY)
TR 801A-3	AFGL 801A THERMAL CYCLING TEST
TR 801A-8	AFGL 801A THERMAL-VACUUM TEST
TR 804A-1	AFGL 804A VIBRATION TEST
TR 804A-1A	AFGL 804A COVER MECHANISM VIBRATION TEST
TR 804A-2	AFGL 804A PRESSURE TEST (ASCENT ENTRY)
TR 804A-2.1	AFGL 804A PRESSURE TEST (SEAL)
TR 804A-3	AFGL 804A THERMAL CYCLING TEST
TR 804A-3A	AFGL 804A COVER MECHANISM THERMAL CYCLING TEST
TR 804A-8	AFGL 804A THERMAL-VACUUM TEST
TR 804A-8A	AFGL 804A COVER MECHANISM THERMAL-VACUUM TEST
TR 804B-1	AFGL 804B VIBRATION TEST
TR 804B-2	AFGL 804B PRESSURE TEST (ASCENT/ENTRY)
TR 804B-3	AFGL 804B THERMAL CYCLING TEST
TR 804B-8	AFGL 804B THERMAL-VACUUM TEST
TR CRL-258-1	CRL-258 VIBRATION TEST
TR CRL-258-2.1	CRL-258 PRESSURE TEST (LOW TEMPERATURE SEAL)
TR CRL-258-2.2	CRL-258 PRESSURE TEST (LONG DURATION VACUUM)
TR CRL-258-3	CRL-258 TEMPERATURE TEST
TR CRL-258-8	CRL-258 THERMAL-VACUUM TEST


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8